DATED HISTORY

Unified Notation and Claim Registry for the Scalar-Selection Program

Notation and claim registry from the scalar-selection program. Later closure and clock audits supply the disposition of the simulator claims.

Manuscript · p. 1, registry scope

A Test Protocol for Scalar Timing Closure and Dimensional Selection

Evidence · Scalar source/window residual audit

Unified Notation and Claim Registry for the Scalar-Selection Program

Purpose

This note unifies notation and claim scope across the four-paper scalar-selection program. Its role is organizational: to define symbols once, record which level of the theory each belongs to, and clarify which claims are structural, effective, experimental, or medium-specific.

1 Program Spine

The central dependency chain is

$$H_{\text{micro}} \longrightarrow W \longrightarrow L_w \longrightarrow d_{\text{eff}} \longrightarrow G_{d_{\text{eff}}}(r) \longrightarrow \Lambda(r) \longrightarrow \omega_{\text{eff}}. \tag{1}$$

The program treats scalar emergent geometry as the first robust observable sector. The main hypothesis is that observable scalar geometry is the stabilized survivor of a richer substrate after coarse graining and selection.

2 Notation Registry

Symbol	Meaning	Level	Role in the program
H_{micro}	Microscopic Hamiltonian of the medium	Microscopic	Node, coupler, and drive dynamics before elimination
$W = (w_{ij})$	Weighted adjacency / coupling matrix	Mesoscopic	Effective programmable graph induced by the medium
D	Degree matrix, $D_{ii} = \sum_j w_{ij}$	Mesoscopic	Builds the Laplacian from the weights
$L_w = D - W$	Weighted graph Laplacian	Mesoscopic / effective	Operator controlling diffusion, smoothing, and scalar response
ρ	Effective source density	Effective	Source term induced by graph switching, bias imbalance, or local drive
Λ_i	Internal scalar load on vertex i	Effective observable	Primary scalar quantity retained after coarse graining

Symbol	Meaning	Level	Role in the program
$\Lambda(r)$	Shell-averaged or radial scalar load	Effective observable	Long-distance scalar profile used for closure tests
$\Lambda_{\text{ext}}(x)$	External scalar load at sensor position x	Effective observable	Quantity measured by an external timing or phase probe
$C(x, i)$	Internal-to-external coupling kernel	Effective coupling map	Maps internal scalar load to external probe response
κ	Scalar transport / stiffness coefficient	Effective parameter	Sets graph-mediated smoothing strength in the scalar closure
μ	Screening scale	Effective parameter	Controls finite penetration depth and Yukawa-like suppression
A	Source amplitude coefficient	Effective parameter	Converts source density into scalar response
Γ	Relaxation rate coefficient	Effective dynamical parameter	Sets timescales in the dynamical completion
d_{eff}	Effective spectral dimension	Geometric effective observable	Extracted from return-probability or shell-profile scaling
$G_{d_{\text{eff}}}(r)$	Effective Green kernel	Effective geometric object	Determines asymptotic radial behavior of $\Lambda(r)$
ω	Bare clock / oscillator frequency	Observable baseline	Reference frequency before scalar loading
ω_{eff}	Effective local frequency	Observable	Timing-first measurable shifted by scalar load
α	Clock susceptibility to scalar load	Effective observable parameter	Converts scalar load into timing shift
Δy	Fractional timing shift, $\delta\omega/\omega$	Experimental observable	Main quantity for timing-first null searches

3 Core Equations

3.1 Static scalar closure

$$(\kappa L_w + \mu^2 I)\Lambda = A\rho. \tag{2}$$

This is the leading coarse-grained scalar response equation.

3.2 Dynamical completion

$$\partial_t \Lambda + \Gamma(\kappa L_w + \mu^2 I)\Lambda = \Gamma A \rho(t). \tag{3}$$

If $L_w \phi_n = \lambda_n \phi_n$, then modal relaxation rates are

$$\tau_n^{-1} = \Gamma(\kappa \lambda_n + \mu^2). \tag{4}$$

3.3 Scalar timing law

$$\omega_{\text{eff}} = \frac{\omega}{1 + \alpha\Lambda}, \qquad \Delta y \equiv \frac{\delta\omega}{\omega} \approx -\alpha\Lambda \quad (|\alpha\Lambda| \ll 1). \tag{5}$$

3.4 Dimensional-selection closure

In the Gaussian scaling regime,

$$\Lambda(r) \sim G_{d_{\text{eff}}}(r) \sim \begin{cases} r^{2-d_{\text{eff}}}, & d_{\text{eff}} \neq 2, \\ \log r, & d_{\text{eff}} = 2. \end{cases} \tag{6}$$

The weak-field branch matching a $1/r$ envelope is singled out by $d_{\text{eff}} \approx 3$.

4 Claim Registry

A. Structural claims internal to the framework

- A graph-mediated scalar sector can be represented at leading order by a screened weighted-Laplacian closure.
- The same promoted graph that carries scalar response can define an effective spectral dimension.
- Timing-first observables are the natural first probes of the scalar sector.

B. Claims requiring direct numerical closure

- Agreement of diffusion-based and shell-profile-based estimates:

$$d_{\text{eff}}^{(\text{diff})} \overset{?}{\approx} d_{\text{eff}}^{(\Lambda)} \overset{?}{\approx} 3. \tag{7}$$

- Existence of a stable intermediate scaling window supporting the Gaussian regime.
- Robust extraction of μ and the modal relaxation spectrum.

C. Claims requiring medium-specific derivation

- Mapping from microscopic device parameters to W, ρ, and Λ.
- Derivation of the internal-to-external kernel $C(x, i)$.
- Quantitative prediction of timing residuals for a specific hardware platform.

D. Claims requiring experiment

- Any nonzero timing-first signature.
- Any measurable screening length in a real source medium.
- Any topology-vs-mass separation in a controlled null experiment.

5 Paper-to-Paper Mapping

1. **Selection / projection scalar geometry paper:** introduces the ontology, the scalar chain, dimensional selection, and local-vs-global nonuniqueness.
2. **Timing-first paper:** defines the main measurable Δy, the screened magnitude estimates, and the discriminant logic.
3. **First-bound hardware paper:** proposes the first reconfigurable medium and the first empirical bounds on $(\alpha A, \mu, \Gamma)$.
4. **Microscopic medium-mapping paper:** derives the closure from a concrete medium Hamiltonian and identifies the internal scalar load.

6 Minimal Reading Rule

When interpreting the program, the reader should always ask:

1. Is the symbol microscopic, effective, or directly observable?
2. Is the claim structural, numerically testable, medium-specific, or experimental?
3. Does the argument live at the internal medium level or the external probe level?

This prevents scope confusion and keeps the four-paper arc logically aligned.